A Quantitative Theory of Time-Consistent Unemployment Insurance

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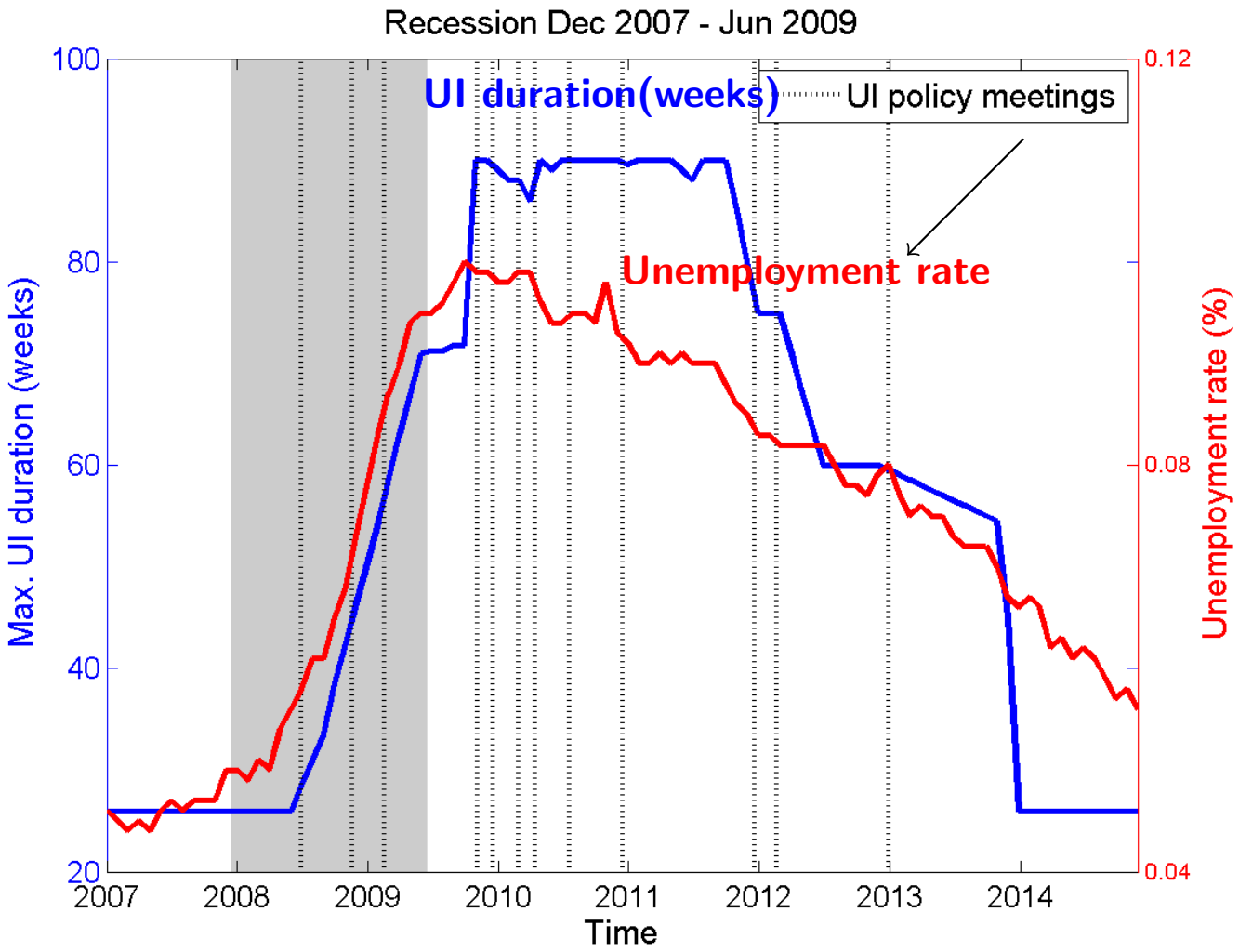
Unemployment Insurance (UI) Extensions in the U.S.

- In the U.S. unemployment insurance (UI) is provided to unemployed workers for a finite duration (typically up to 26 weeks)
- Potential duration extended during recessions (implemented since 1970s)
  - Longer durations during economic downturn and high unemployment
  - Extensions implemented gradually by Congress (discretionary policy)

Figure: Potential UI duration and Unemployment during Great Recession



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- Potential duration extended during recessions (implemented since 1970s)
  - Longer durations during economic downturn and high unemployment
  - Extensions implemented gradually by Congress (discretionary policy)
- Two groups of literature on UI extension
  - evaluate effects of extension
  - optimal UI extensions with policy commitment

Time-Inconsistency Problem

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  - Today: promise benefits expire tomorrow $\rightarrow$ higher search, lower unemployment
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- As such, govt always has incentive to deviate from pre-determined plan
  - Optimal UI in literature assumes govt has commitment
  - In reality, likely no commitment, esp. in recession

This Paper

- **Time-consistent** UI policy in a standard labor market environment
  - Can be implemented by government **without** assuming commitment, i.e. *discretionary* policy
- *Question*: 'Does time-consistent UI policy look like U.S.?'
  - Extensions during recessions consistent with U.S. pattern
- *Question*: 'How does government's policy commitment matter?'
  - With policy commitment (Ramsey), UI duration is **shorter** in steady state, and **shortened** in recessions

Literature

- Optimal UI with gov't commitment + business cycle
  - Mitman and Rabinovich (2015), Jung and Kuester (2015), McKay and Reis (2017), Landais et al (2018)
  - We look at *time-consistent* policies under *no commitment*
- Other time-consistent policy
  - Alesina and Tabellini (1990), Chari and Kehoe (2007), Klein, Krusell and Ríos-Rull (2008), Yared (2010), Song, Storesletten and Zilibotti (2012), Bianchi and Mendoza (2018)
  - First application of time-consistent concept to UI and labor market search
- Evaluate UI benefit extensions
  - Rothstein (2011), Nakajima (2012), Hagedorn, Manovskii and Mitman (2015)
  - As an application of our model

Model

Environment

Standard search-and-matching model

- Infinitely-lived workers differ by employment and benefit status
  - $1-u$: employed earn wages, no search, exogenous separation from work
  - u: unemployed consume home goods, costly job search, finding rate proportional to search
  - u^1: benefit-eligible unemployed receive benefits
- Firm: risk neutral, pays fixed cost to post vacancy
- Aggregate states: $\mathcal{O} = (z, u, u^1), \quad u > u^1$
  - exogenous: productivity z follows AR(1) process
  - endogenous: unemployment u, measure of benefit-eligible unemployed u^1

Government Policy

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- Benefit level $\boldsymbol{b}$ given to benefit-eligible unemployed workers
- Probability $\boldsymbol{d}$ unemployed with benefits yesterday keeps eligibility
  - Same probability for all eligible unemployed
  - If lost benefits today, not eligible until re-qualifies through work
  - Max. potential (Expected) duration from today is $1/(1-\boldsymbol{d})$

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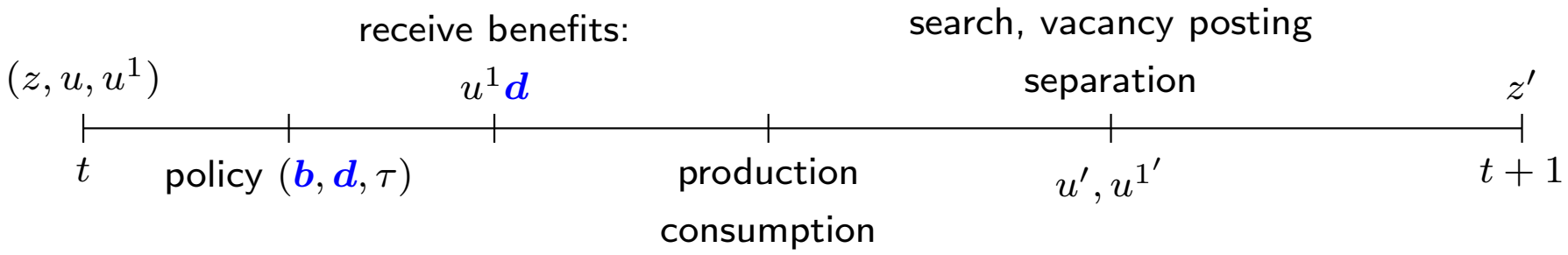
- Lump-sum tax τ to balance budget

Timing of Events

Aggregate states: $\mathcal{O} = (z, u, u^1)$



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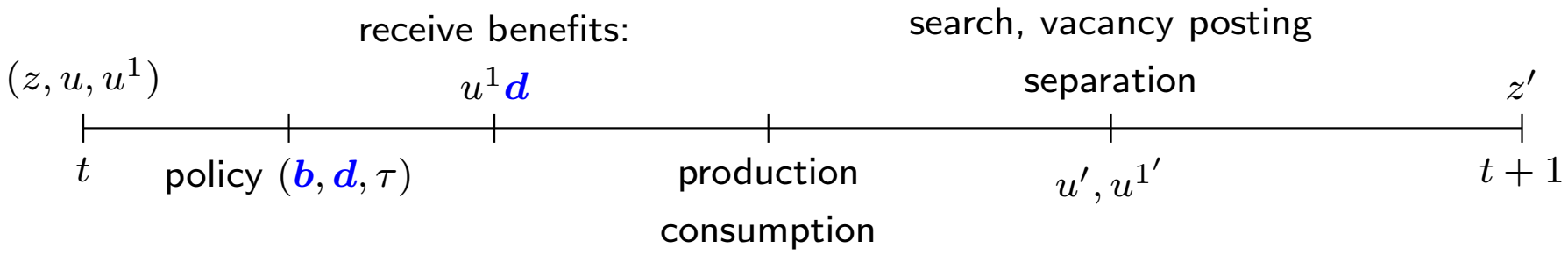

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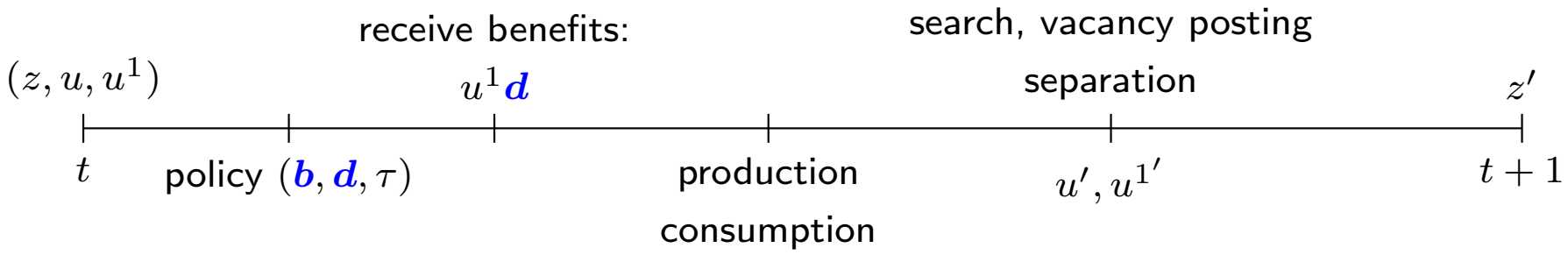

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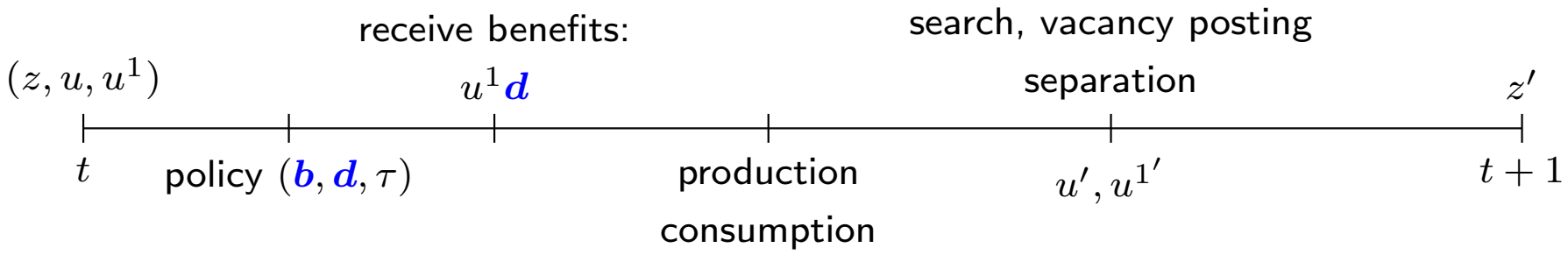

- Today's search affects unemployment tomorrow
- Expectation of future UI policy affects today's search
- Today's duration policy ($\boldsymbol{d}$) changes proportion of unemployed on benefits

Preference and Technology

- Worker's preferences:

$$U(c,s) = \underbrace{u(c)}_{\text{utility from consumption}} - \underbrace{v(s)}_{\text{disutility from search}}$$

- Linear production technology: productivity z
  - Wages are exogenous function of z and UI duration: $w = W(z,d)$
- Matching technology: number of new matches is

$$M(\underbrace{V}_{\text{total firm vacancy}}, \underbrace{I}_{\text{total search by unemp'ed}})$$

  - Market tightness: $\theta = V/I$. Vacancy-filling rate: $q(\overset{-}{\theta})$. Job-finding rate: $sf(\overset{+}{\theta})$

Workers

▸ worker's problem

- Life-time utility maximizers, take UI policy $(\boldsymbol{b}, \boldsymbol{d})$ as given
- Unemployed without benefit search (s^0) until

$$\underbrace{v_s(s^0)}_{\text{marginal cost}} = \underbrace{f(\theta)\beta\mathbb{E}\left[V^e(\mathcal{O}') - V^0(\mathcal{O}')\right]}_{\text{marginal gain}}$$

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Proposition

- *Unemployed workers with benefits search less* $(s^1 < s^0)$
- *Longer expected* **future** *UI duration* (d') *lower search* (s^1)

Firms and Production

firm's problem

- Maximizes expected FDV of profits, take UI policy (b, d) as given
- Free-entry of vacant firms, pays cost κ to post vacancy until

$$\underbrace{\kappa}_{\text{marginal cost}} = \underbrace{q(\theta)\beta\mathbb{E}\left[\overbrace{z' - w'}^{\text{future profit}} + \overbrace{(1-\delta)\frac{\kappa}{q(\theta')}}^{\text{saved job posting cost}}\right]}_{\text{marginal gain}}$$

Government's Problem With Commitment (Ramsey)

Govt chooses at time 0 **all future policies** to maximize PDV of welfare

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \underbrace{R(\overbrace{z_t, u_t, u_t^1}^{\text{states}}, \overbrace{b_t, d_t}^{\text{policy}}, \overbrace{s_t^0, s_t^1}^{\text{search}})}_{\text{time-t worker's welfare}}$$

subject to private-sector optimality conditions, balanced budget **for all time** t

- assumes govt sticks to policies determined at time 0, otherwise cannot be implemented

Government's Problem Without Commitment

Given current states, govt chooses **current** policies (b, d) and allocations, **taking future policy rules as given**

$$\max \quad \underbrace{R(z, u, u^1, b, d, s^0, s^1)}_{\text{worker's welfare today}} + \beta \mathbb{E} G(\underbrace{z', u', u^{1'}}_{\text{future states}})$$

subject to private-sector optimality, balanced budget for **current** period

- Equilibrium: today's govt and agents take future policy rules as given; today's policy rules coincide with the expected future policy rules
- The equilibrium (Markov-perfect equilibrium) is time-consistent

Intuitions: Effects of UI Extension

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Without commitment: higher today's welfare vs higher future unemployment

With commitment: govt also considers ex ante effect of **promised** extension

- *Recall* in worker's problem, expected **future** extension lowers search
- promised extension lowers **previous** search and increases today's unemployment

Intuition: UI Extension in Recessions

Lower productivity (exogenous)

Higher unemployment (endogenous)

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Lower productivity (exogenous)

- Smaller loss from high future unemployment (smaller search effects)

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- Extension benefits more people (larger insurance effect)

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Higher unemployment (endogenous)

- Extension benefits more people (larger insurance effect)

→ Without commitment: Higher unemployment → Longer extensions

- **Promised** extension lowers search of more people (larger ex ante search effect)

→ With commitment: Shorter extensions or reduce UI duration

Quantitative Analyses

Calibration Strategy

- Calibrate model to match monthly U.S. labor market statistics

Table: Key moments for calibration

Moments	Value
Monthly job separation rate	0.02
Wage elasticity wrt productivity	0.446
Wage change wrt one-week longer UI	$\{\mathbf{0}, 0.02\%\}$
Average monthly job-finding rate	0.4
% unemployed on UI	0.45
UI replacement ratio	40%
Δunemp duration/ΔUI extension (search effect only)	0.16

▸ calibrated parameters ▸ other moments

Effects of Policy Commitment at Steady State

Table: Equilibrium steady state comparison

Statistics	No commitment	With commitment
UI Duration(weeks)	27	15.8
Unemployed worker search, s^1	0.29	0.38
Proportion UI recipients	0.45	0.33
Average job finding rate	0.42	0.48
Unemployment(%)	4.55	3.99

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  $\rightarrow$ steady state UI duration is much shorter

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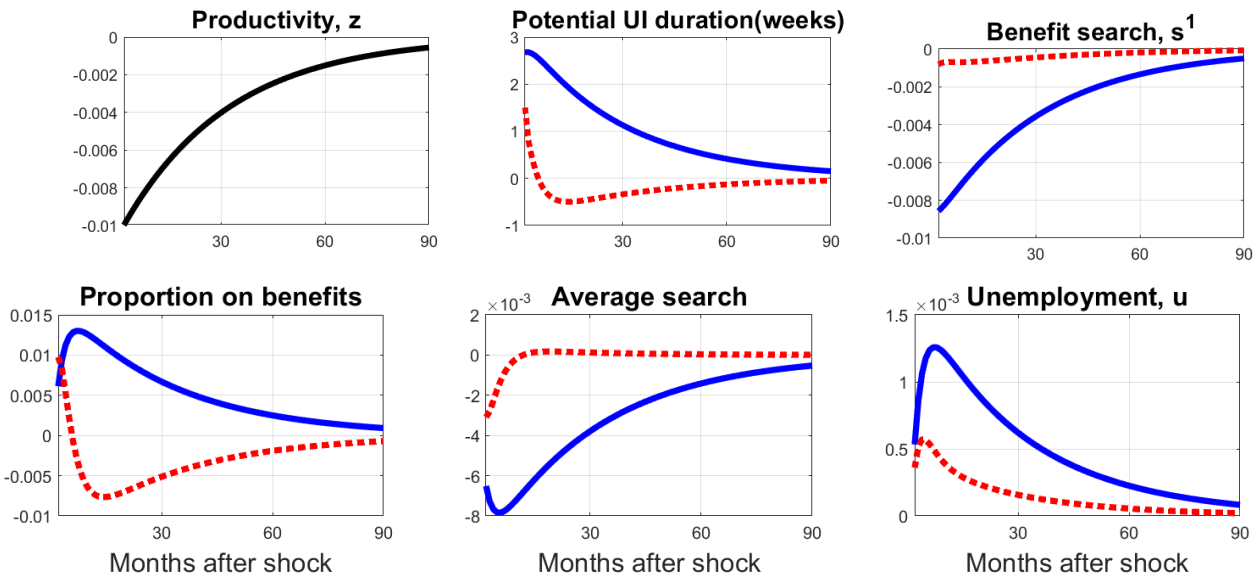
  - $\rightarrow$ search is much higher, fewer unemployed workers collecting benefits
  - $\rightarrow$ unemployment lower

Effects of Policy Commitment: Impulse Response

Figure: Deviations from Steady states to 1% drop in productivity

No commitment (**blue**) vs With commitment (**red**)



Statistics	Standard deviation	
	No commitment	With commitment
UI Duration(weeks)	5.69	0.082
Search, s^1	0.051	0.009
Unemployment, u	0.106	0.052

Great Recession

UI Extensions in the Great Recession

- Federal govt gradually extended max. potential UI duration to over 90 weeks

Figure: Examples of UI extension laws during the Great Recession

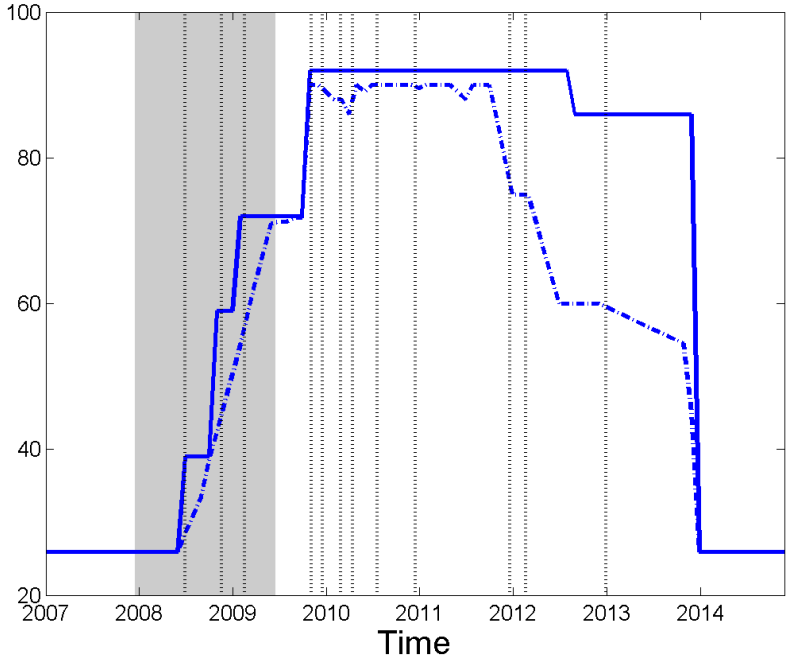
Start date	Program extension of EUC08	End date	Additional Weeks
Jul 2008	13 weeks for all states	Nov 2008	13
Nov 2008	Tier I: 20 weeks for all states Tier II: 13 weeks for states with TUR $\geq 6\%$	Mar 2009	33
Mar 2009	keep exisiting structure	Nov 2009	33
Nov 2009	Tier I - 20 weeks for all states Tier II: 14 weeks for all states Tier III: 13 weeks if states TUR $\geq 6\%$ Tier IV: 6 weeks if states TUR $\geq 8.5\%$	Dec 2009	53
Dec 2009	keep exisiting structure	Aug 2010	53

- Does no-commitment UI policy generates similar extensions?

UI Extensions in the Great Recession

- Step 1: Create cross-state weighted measure of benefit duration as data counterpart (details)

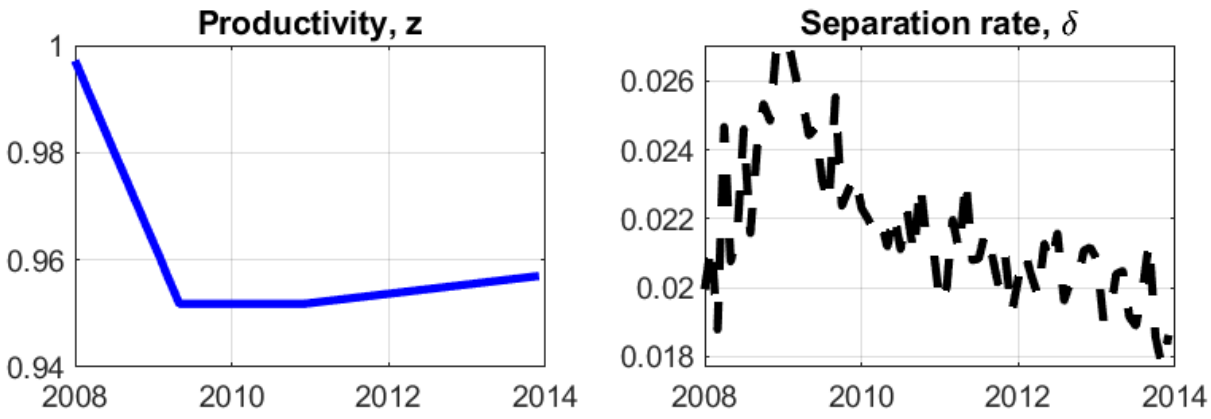
Figure: Legislative (▬) and Weighted (▬•▬) UI durations



UI Extensions in the Great Recession

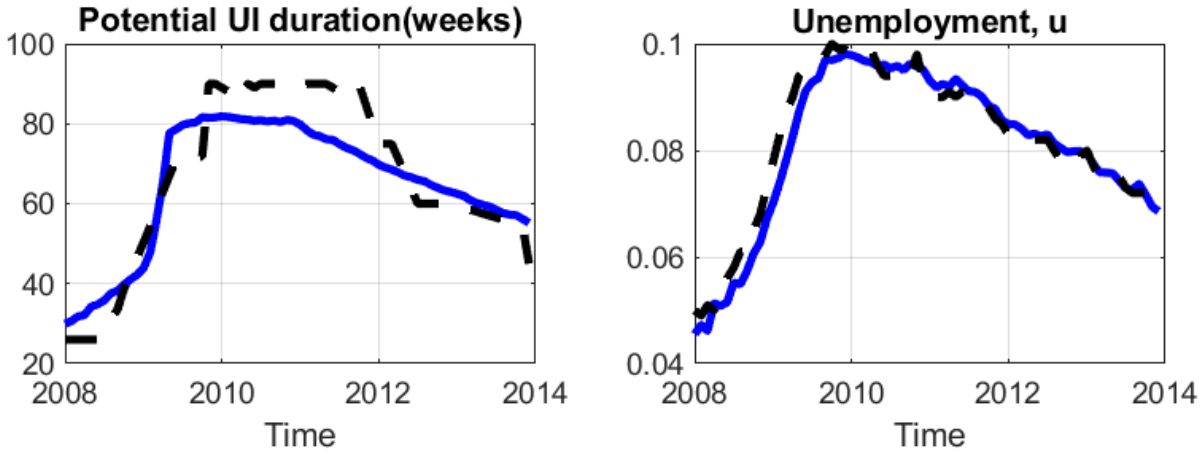
- Step 2: Feed shock paths into the model
  - Job separation rates taken from data
  - Productivity calibrated so that equilibrium unemployment series matches data

Figure: Shocks during Great Recession



Non-Commitment UI Policy in the Great Recession

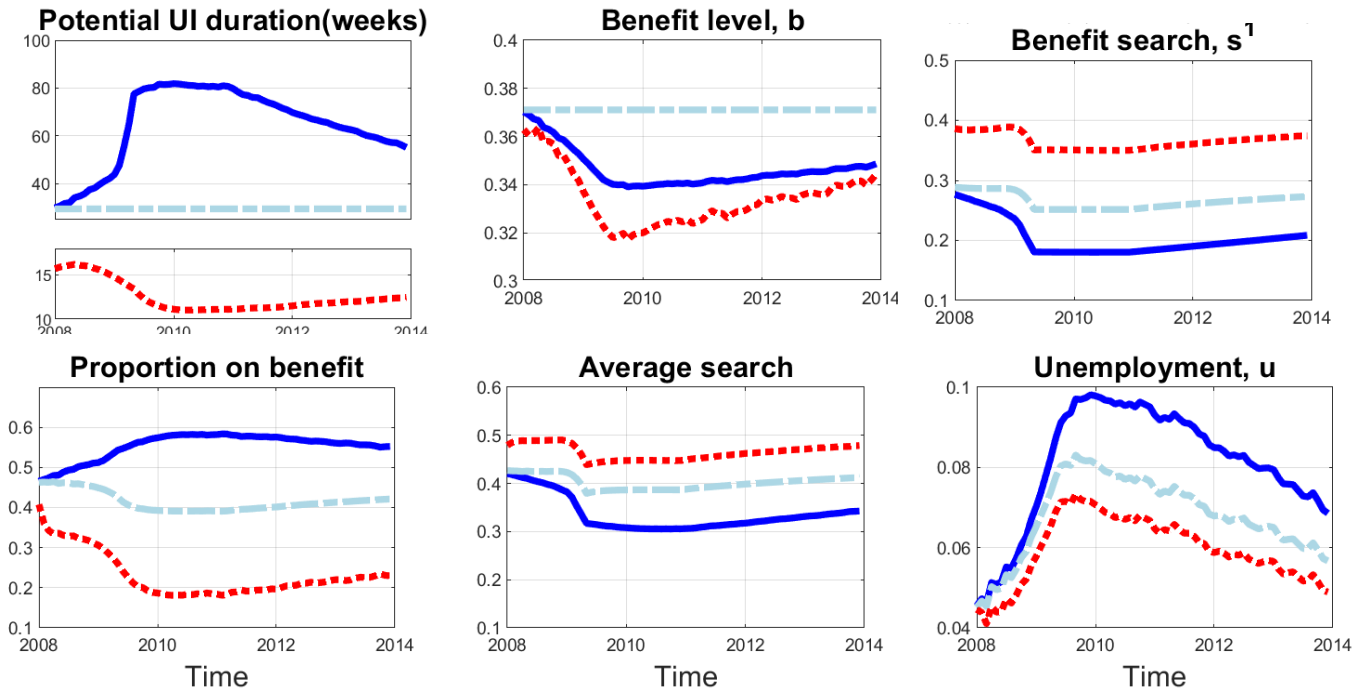
Figure: UI Extensions in Great Recession: Data (**black**) vs Model (**blue**)



- UI extensions under govt without commitment match data well
- lower productivity → extension → higher unemployment → further extension

Great Recession: Comparison of UI Policy Regimes

Figure: No commitment (**blue**) vs With commitment (**red**) policies in Great Recession



- With commitment: shorten UI duration in recession → unemployment lower
- Welfare gain (of lifetime consumption) by adopting policy commitment
  - 0.11% if adopted before recession (2007 Dec)
  - 0.14% if at peak of recession (2010 Mar) – harder to be credible

Conclusion

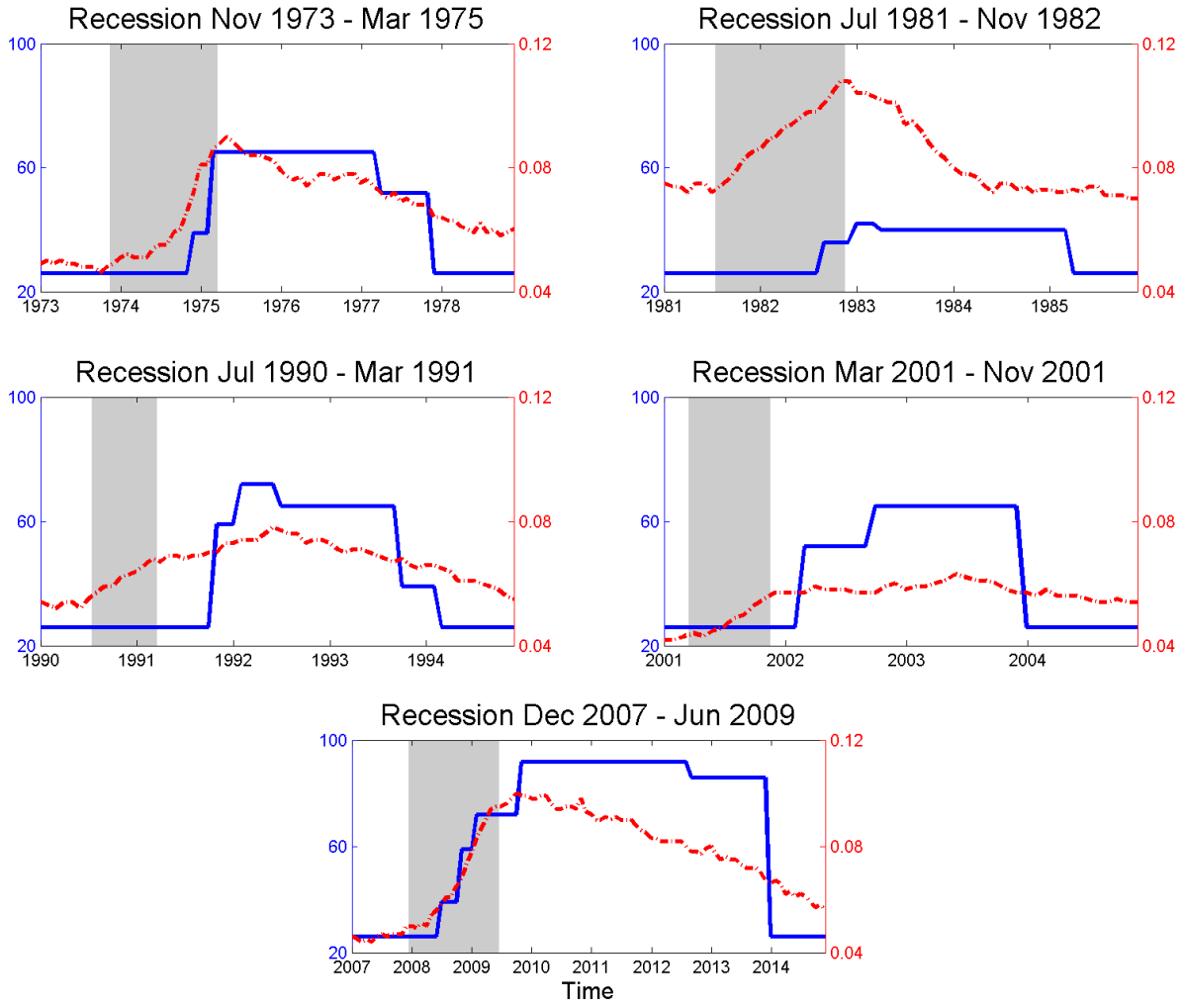
- Time-consistent UI policy (no policy commitment) quantitatively consistent with UI extensions during Great Recession
- With policy commitment (Ramsey) govt reduces UI during recession, leads to **lower** unemployment and welfare gains
- Policy lessons:
  - Design of UI policy should account for government's ability to commit
  - Commitment policy is *tougher* but better outcome overall. Might be hard to implement (*unpopular*), esp. during recessions

Appendix

Historical UI Extensions during Recessions

back

Figure: UI duration (▬) and unemployment (▬•▬) during recessions since 1970s



Unemployed Worker's Problem

back

Take as given govt policy rules for b, d, per-unit job-finding prob $f(\theta)$

Aggregate states: $\mathcal{O} = (z, u, u^1)$

- Unemployed without benefit search s^0

$$V^0(\mathcal{O}) = \max_{s^0} \; U(h-\tau, s^0) + f(\theta)s^0 \underbrace{\beta \mathbb{E} V^e(\mathcal{O}')}_{\text{find a job}} + (1-f(\theta)s^0) \underbrace{\beta \mathbb{E} V^0(\mathcal{O}')}_{\text{don't find a job}}$$

- Unemployed with benefit search s^1

$$V^1(\mathcal{O}) = \max_{s^1} \; U(h+b-\tau, s^1) + f(\theta)s^1 \underbrace{\beta \mathbb{E} V^e(\mathcal{O}')}_{\text{find a job}}$$

$$+(1-f(\theta)s^1) \underbrace{\beta \mathbb{E}\Big[d' V^0(\mathcal{O}') + (1-d')V^1(\mathcal{O}')\Big]}_{\text{don't find a job, may still eligible tomorrow}}$$

Firm

back

Take as given government policy rules for b, d, job-filling probability $q(\theta)$

Aggregate states: $\mathcal{O} = (z, u, u^1)$

- Producing firm gets profit $z - w(z)$

$$J^e(\mathcal{O}) = z - w(z) + \delta \underbrace{\beta \mathbb{E} J^u(\mathcal{O}')}_{\text{match breaks}} + (1-\delta) \underbrace{\beta \mathbb{E} J^e(\mathcal{O}')}_{\text{match stays}}$$

- Vacant firm posts job at fixed cost κ

$$J^u(\mathcal{O}) = -\kappa + q(\theta) \underbrace{\beta \mathbb{E} J^e(\mathcal{O}')}_{\text{match formed}} + (1 - q(\theta)) \underbrace{\beta \mathbb{E} J^u(\mathcal{O}')}_{\text{no match}}$$

Markov Equilibrium

back

A Markov-perfect equilibrium is a set of value functions, government policy rules and private-sector decision rules such that for all $\mathcal{O} = (z, u, u^1)$

- Given government policy rules, private-sector decision rules solve private-sector problems
- Given private-sector decision rules and future government policy rules, current government policy rules solve the government's problem
- Policy rules obtained by solving government problem coincide with future government policy rules that the government problem **takes as given**
- Worker's flow equations satisfied

Table: Estimated effect of UI benefit extension on unemployment duration (micro-elasticity)

Estimate ΔUI dur$\rightarrow\Delta$unemp dur	Source	Estimation methodology
1 week$\rightarrow$0.16 weeks	Moffitt (1985)	Cross-state and time differences in UI duration
1 week$\rightarrow$0.16-0.20 weeks	Katz and Meyer (1990)	Simulated UI extension from 26 to 39 weeks
13 weeks$\rightarrow$1 week	Card and Levine (2000)	13 week extension in NJ in 1996 (non-recession
10 weeks $\rightarrow$1.5 weeks	Valletta (2014)	Discrete hazard analysis; follow Rothstein (2011
1 month$\rightarrow$10 days	Johnston and Mas (2016)	UI duration cut in MS in 2011; regression disco

Note: Estimates cited are the increase in individual (those who collect benefits) unemployment duration to
13 weeks, 1 month).

Calibrated Parameters

back

	Externally calibrated parameters	Values
δ	U.S. job separation rate	0.02
κ	Vacancy posting cost	0.58
ρ	Persistence of productivity	0.968
σ_ϵ	Std of innovation to productivity	0.006
ϵ_w	Elasticity of wage wrt productivity	0.45
$\bar{w}$	Steady-state wage	0.977
	Internally calibrated parameters	
h	Value of nonmarket activity	0.59
χ	Matching parameter	4.52
α	Disutility of search	3.2
ξ	Prob. newly unemployed is benefit eligible	0.49

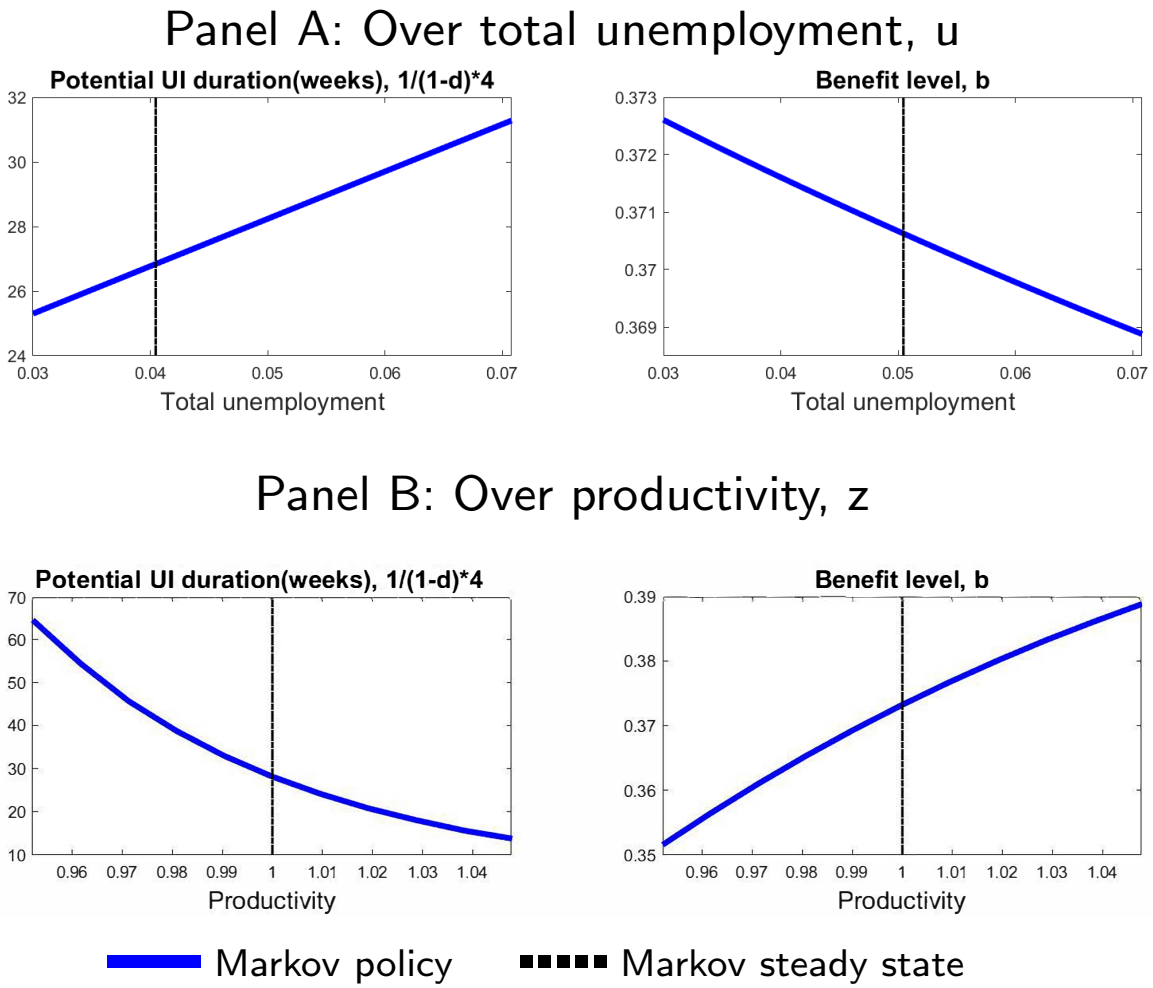
Untargeted Moments

back

Key Non-Target Moments	Data	Model
Average UI Duration	26	27
Std dev of unemployment u	0.123	0.106
Std dev of vacancy posting v	0.142	0.142
Std dev of v-u ratio	0.257	0.217

Markov UI Policy Functions

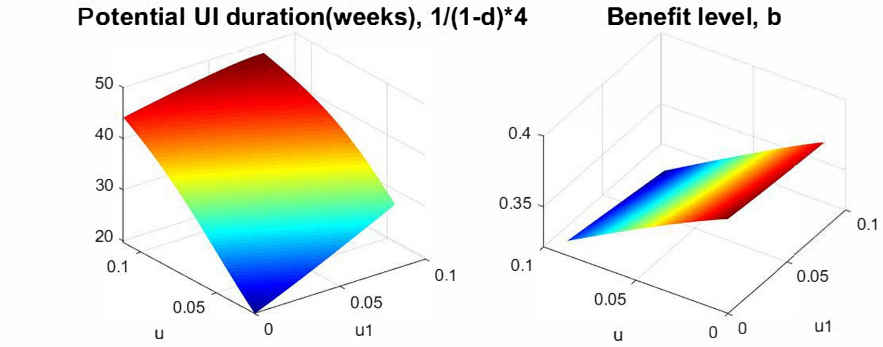
Figure: Markov equilibrium UI policy functions over total unemployment and productivity



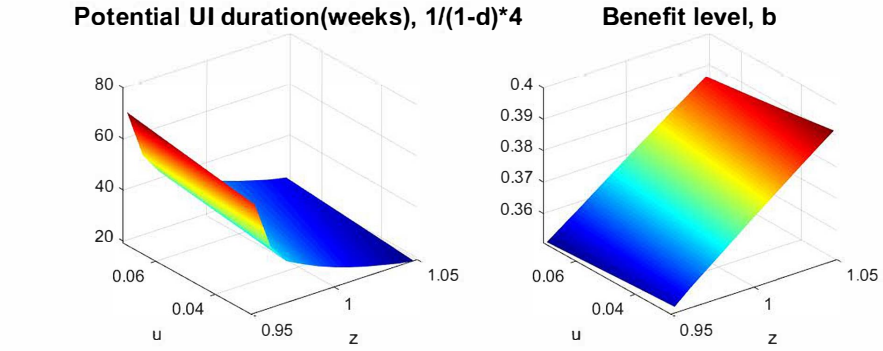
Markov UI Policy Functions: 3-D

Figure: Markov equilibrium UI policy functions in 3-D

Panel A: Over total and benefit-eligible unemployment



Panel B: Over total unemployment and productivity



Ramsey UI Policy Functions

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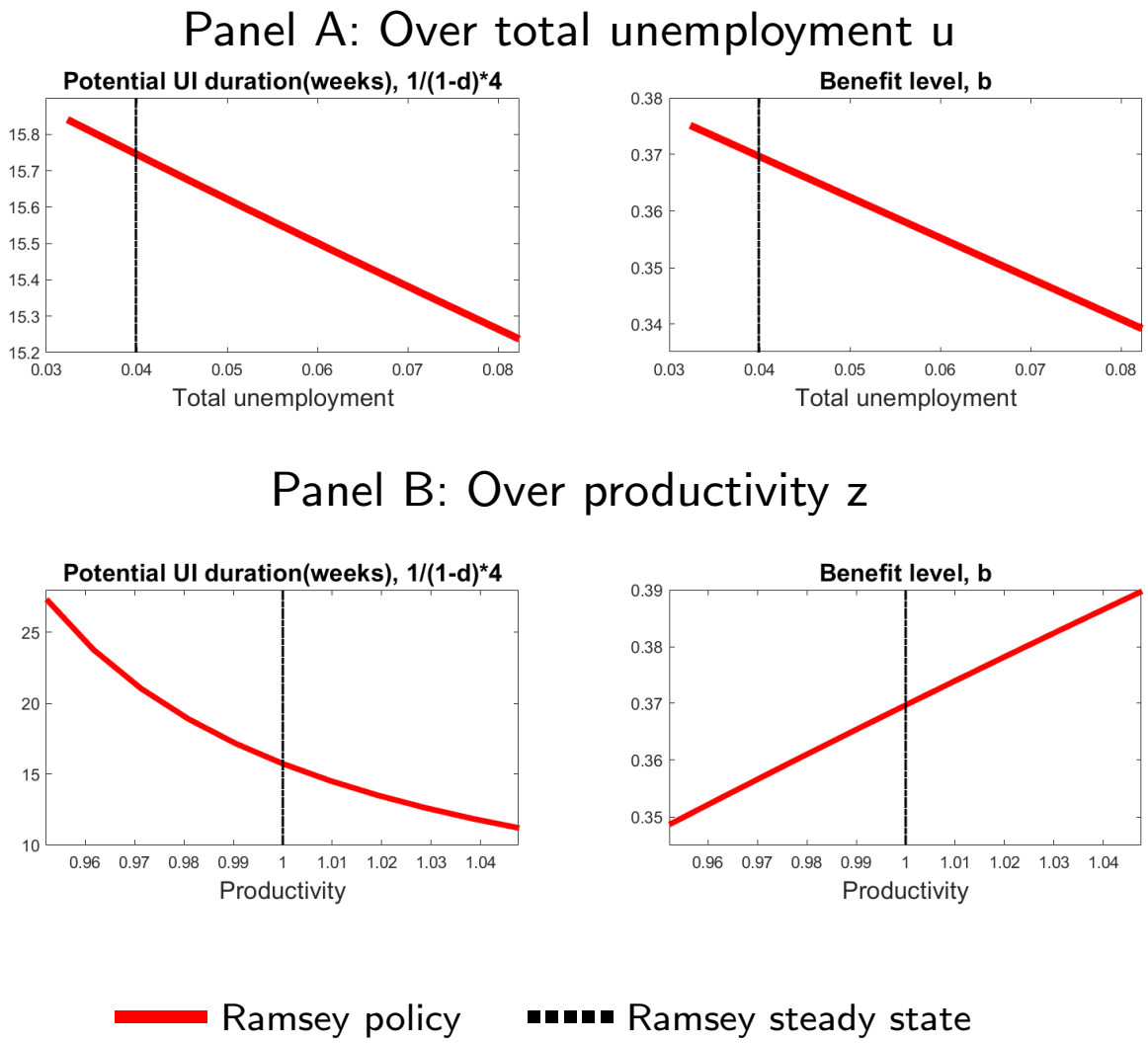
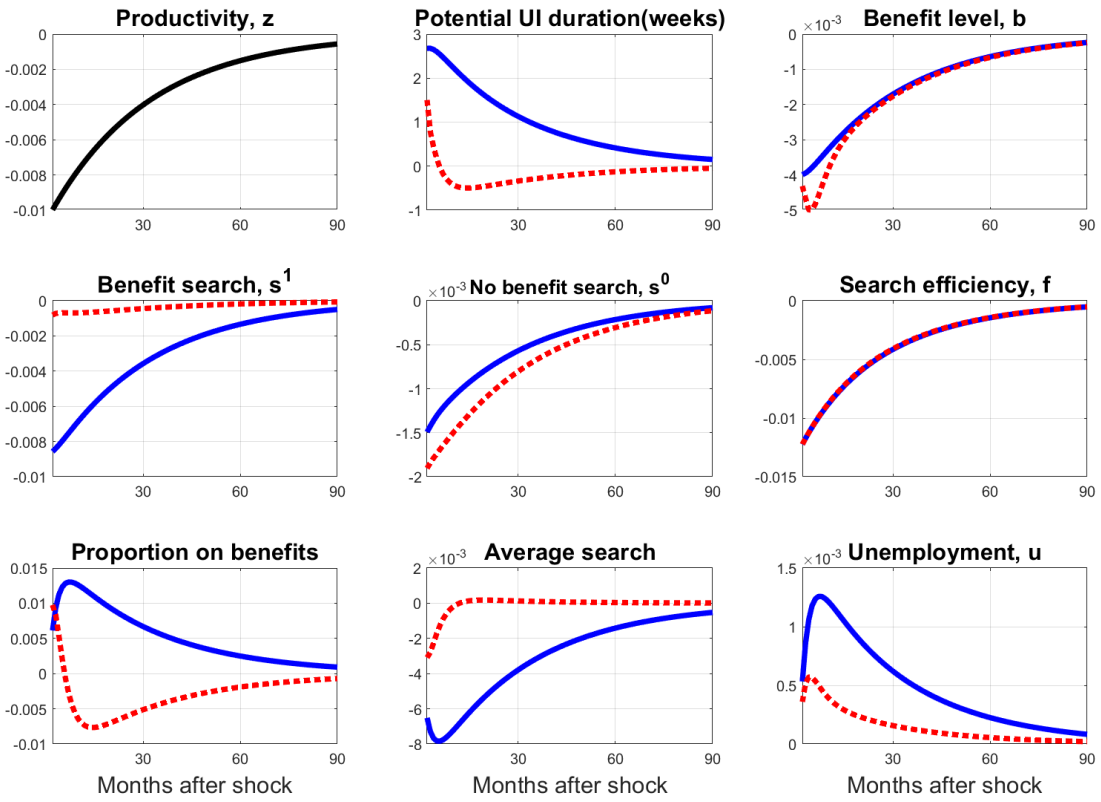


Effects of Policy Commitment: Impulse Response

Figure: Impulse Response (deviations from Steady states to 1% drop in productivity)

No commitment (**blue**) vs With commitment (**red**)



Constructing weighted measure of UI duration

- UI law during recession specifies maximum UI extension a state qualifies depending on unemployment
- Use insured unemployment rate (IUR) and total unemployment rate (TUR) to determine whether state eligible for extended durations at any time
- Use states' total insured unemployed as the weight
- Compute sum of weighted UI extension across all states